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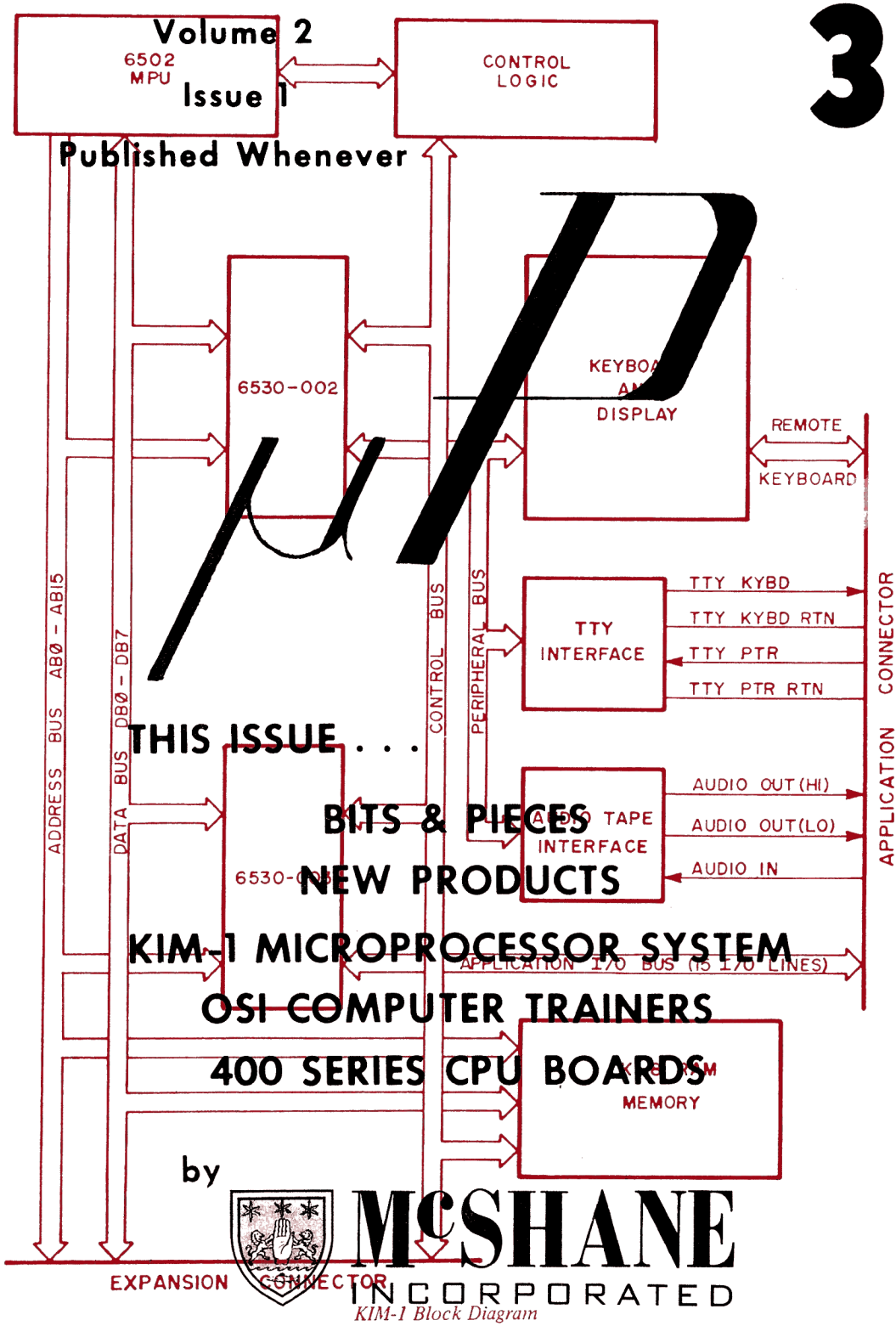


THIS ISSUE . . .

BITS & PIECES

NEW PRODUCTS

KIM-1 MICROPROCESSOR SYSTEM

OSI COMPUTER TRAINERS

400 SERIES CPU BOARDS

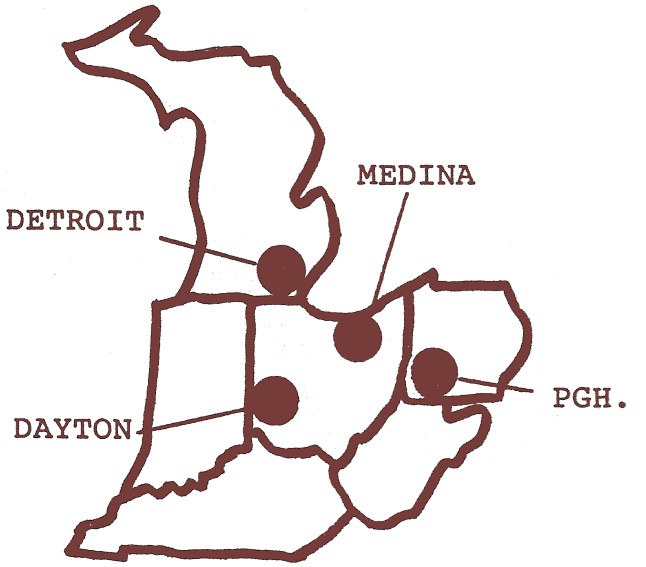
by

McSHANE INCORPORATED

KIM-1 Block Diagram

ABOUT McSHANE. . .

As Manufacturers' Representatives, McShane covers the following area for most of our lines:



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McShane, Inc.
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Kel Humphreys - Sales
Jean Humphreys - Secretary

Detroit, Michigan (Branch Office)
(Opening Soon)

Pittsburgh, Pennsylvania (Branch Office)
(Opening Soon)

M^{C}Shane represents the following firms and products:

GREGG ELECTRIC
- Counter, Panel Mounted
- Clock, 24 Hr. Digital, Panel Mounted
- Clock, 24 Hr. Systems Instrument
- Events/Unit Time Counter

TRANSISTOR DEVICES, INC.
- Power Supply Modules
- Rack Mounted Power Supplies
- Power Supply Systems
- OEM Custom Supplies

OVEN INDUSTRIES, INC.
- Temperature Controllers
- Crystal, Oscillator & Component Ovens

VELONEX DIV/VARIAN
- Digital Panel Meters

MOS TECHNOLOGY, INC.
- Microprocessors
- Custom MOS Circuits & LSI's
- Calculator LSI's
- ROM's, Counters & Shift Registers
- Keyboard Encoders

FERNWOOD TRANSFORMERS
- Power Transformers
- Audio Transformers
- Custom Magnetics

NEICO MICROWAVE CO.
- Microwave Components & Assemblies

OHIO SCIENTIFIC INSTR.
- Microcomputer trainers, CPU boards, expansion boards, related hardware and texts

COMPUSYSTEMS
- Computer: An APL Programmable, Portable Standalone, up to 118K Useable Memory & 1/4 Megabytes Storage. Peripherals are also available.

ILC DATA DEVICE CORP.
- Analog/Digital Converters
- Digital/Analog Converters
- Synchro/Digital Converters
- Inductosyn/Digital Converters
- Angle Indicators
- Shaft Encoders
- Synchro Simulators
- Solid State Limit Switches
- Wideband Op-Amps
- Custom Hybrids
- Data Aquisition Systems
- Microcomputer Systems

AIR-VAC ENGINEERING CO.
- Solder Removal Tools
- IC De-Soldering Machines
- Air Operated Vacuum Pumps
- Vacuum Part Handling Probes

SPECTRUM DYNAMICS
- PROM Programmers/Verifiers

WELLS ELECTRONICS, INC.
- IC Test Sockets
- IC Carriers
- Custom Plastic Molding

HYPERTRONICS, INC.
- Connectors & Contactors for Cables and PC Boards

COMPASS, INC.
- Software engineering, & special microprocessor hardware

We presently stock products of:

MOS Technology
- KIM-1 Microprocessor System
- 6502 Microprocessor
- 6530-002 TIM Monitor
- 6530-005 I/O and Interval Timer
- 7529-103 Calculator Chip
- Hardware Manuals
- Software Manuals

OSI
- #400 CPU Boards
- #420 Memory Expansion Boards

Wells Electronics
- Zero Insertion Force Sockets 14,16,24 and 40 pins.

The following products are available from M^{C}Shane:
- Infoton CRT Terminals & Displays (Distributorship)
- Diablo Printers and Printer/Plotters
- TL Industries - Printers (OEM)

CALCULATOR CHIPS...

MOS Technology has long been considered a technological leader when it comes to the design and mass production of devices used in OEM quantities by large manufacturers of calculators. Several new devices have recently been announced, however, the MCS 7529-103 may be the most attractive to small quantity users of the 6502 in view of its low cost in small quantities and off-the-shelf delivery. New pricing on the MCS 7529-103 is $16.50 in lots of 1 to 99.

Ohio Scientific Instrument will soon make available their Model 450 firmware basic board, and it will use the 7529-103 calculator chip for all arithmetic functions. Additional information on the device follows:

The 40 Key single chip calculator Array MPS 7529-103 operates in conjunction with a twelve digit display and a 40 key keyboard to allow execution of both arithmetic and transcendental functions.

Operating features of the system include:
- Number entry in floating point or scientific notation.
- Automatic selection of correct notation for result display (scientific or floating point).
- Algebraic problem entry.
- Two parenthesis levels.
- 8 digit mantissa.
- Sign selection and display.
- Full chain calculation with any function sequence.

Functional features of the system include:
- Basic arithmetic (+,-,x,÷)
- Trig Functions (sin, cos, tan)
- Inverse trig functions(sin-1 ,cos-1, tan-1)
- Logarithms (ln and log)
- Anti-logarithms (e^x and 10^x)
- Exponentiation (y^x)
- Factorials (n!)
- Convenience functions (1/x,x^2, x,)
- Full feature memory (STO, RCL, M+)
- Exchnge operations (xy)
- Degree radian selection (Trig or Inverse Trig)
- Automatic error detection and display
- Clearing operation and display (CA, CE)

Electrical features of the system include:
- Minimum system power consumption.
- Direct LED segment drive.
- Internal display cutoff (for battery life extension; no external components).
- Internal clock oscillator and drivers. (No external components.)
- Internal power-on-clear circuit (no external components).
- Internal key validation, debouncing, and noise rejection (no external components.)

This array is manufactured with a low threshold P-Mos process utilizing ion implantation techniques and is supplied in a 28 pin dual-in-line package.

PROM ERASING LAMPS...

We have been told you can purchase a very low cost ultra violet lamp from your local Barbers Supply House. These lamps are used as germicidal lamps for combs and other barber tools. A lamp large enough to erase one chip costs less than two bucks and we understand five dollars will get a lamp large enough to erase three devices at a time.

TIMESHARING SYSTEMS PROVIDING CROSS ASSEMBLER SERVICE...

Cross Assembler programs for the MCS-650X series is now available from:

UCS	This system is "up", running and available.
NCSS	This system is "up". It has yet to be advertised, but it is running and available. Access code: P-650X.
GE	Will go on line soon. Have been delays.

MICROPROCESSOR DEVELOPMENT TERMINAL...

The MDT-650 will be delivered against back orders beginning in June. About 4 pre-production units already exist in the field. We have placed orders well in advance, however, these will be sold shortly. It is recommended you place your order with us now if you want early delivery on your terminal. See another section of this issue for a description of the MDT-650.

CHIPS AND STATIC...

While normal handling of the 6502 is not a problem, you are reminded that cold temperatures reduce moisture and increase the level of static charges. Walking across the carpet can build up to thousands of volts. Be sure to discharge your body to ground before handling high impedance LSI devices. Keep your chips in their conductive plastic mounting until ready for use.

HIGH CLOCK SPEEDS...

The MCS-6502 is normally used with the "on-chip-clock" set to operate at 1.0 Mhz. For your information, most of the 6502's now out will operate at 2.0 Mhz. Some will go to 3.0 Mhz and you may find one capable of 4.0 Mhz. 5.0 Mhz is the cut-off.

For devices guaranteed to operate at 2.0 Mhz order the 6502A ($37.50 in lots of 1-99).

MOS TECHNOLOGY MAIL LIST...

If you have not received a newsletter from MOS within the last month and you wish your name to be on the mail list, please send a post card to us showing the proper name and address. We will see that it is entered on the computerized mail list.

16 BIT WORD MICROPROCESSOR...

MOS Technology will soon introduce the MCS-6509, a 16 bit microprocessor handling 8 bits at a time. The MCS-6509 will have the following features:

1) a 16 bit accumulator (8 high and 8 low);
2) an 8 bit ALU;
3) 16 bit stack pointer;
4) 16 bit X index register;
5) 16 bit Y index register.

While the chip will require 25% more instruction execution time, the instruction handles twice the data of the 8 bit chips (faster total through-put) making the device very attractive for greater volume work. The 6509 should be available by September.

6500 CROSS ASSEMBLERS...

Cross Assembler software is available as tape or deck for the following machines:

	IBM	- 360
		- 370
	CDC	- 6400
		- 6600
		- 7600
	PDP	- 10
	XEROX	- SIGMA 5
		- SIGMA 7
		- SIGMA 9
Available Soon....	PDP	- 11

Priced at $1200.00, delivery is two weeks ARO. Contact McShane, Inc.

MICROPROCESSOR MANUALS...

MOS Technology Publishes easily understood manuals on the MCS-6502 microprocessors which are extremely thorough. Beginning with the definition of a "bit", the manuals fully explain how the microprocessor functions and how to develop programs for its actual implementation. The set consists of:

Hardware Manual...$5.00
Software Manual...$5.00

They are available from McShane stock.

SYNCHRO TO DIGITAL...

ILC Data Device, Inc. has recently announced a new 10 bit S/D converter for industrial applications. Known as the SDC-620-I-3, this device is especially suitable for converting shaft positions, table positions, and any other mechanical positioning information to binary digital code. The SDC-620-I-3 is priced at $240.00 in lots of 1-9. The transducer providing the input to the converter can be any standard synchro or resolver.

PDP 11 & MOS/TECHNOLOGY 6502

= MINmic 1165

COMPUTER APPLICATIONS CORPORATION

WHAT IT IS. . .

MINmic 1165 is a new approach to microprocessor system design. Normally you must choose either an inexpensive, hobbyist oriented kit or a powerful but expensive prototype system. MINmic 1165 allows you to use all the memory and peripherals of your existing minicomputer to support the design of microprocessor based systems. It is a complete system made up of hardware and software. The MINmic 1165 board contains an MOS/TECHNOLOGY 6502 processor and all the logic needed to interface to the PDP 11 bus. The MINmic 1165 software is loaded into the PDP 11 and emulates some or all of the MCS 6502 memory. You load your MCS 6502 programs into the PDP 11 with existing peripherals. No additional hardware or software is needed for development.

WHAT IT DOES. . .

The MINmic 1165 software maps MCS 6502 memory references into the PDP 11 address space and performs the appropriate read/write. The software package may be easily enhanced for device simulation, breakpoints, etc. The flexibility of the system is limited only by your own ingenuity. In addition, the MINmic 1165 board contains a ribbon connector which brings all the needed MCS 6502 signals off the board to your own hardware or future MINmic products. Thus, you can configure your system to have part of the MCS 6502 memory space in the PDP 11 and part of the memory space off the board for RAM, ROM, I/O boards, etc.

HOW IT WORKS. . .

The interface between the MCS 6502 and the PDP 11 is a pair of 16 bit registers: the Microprocessor Bus Address Register (MBAR) and the Microprocessor Data and Status Register (MDSR). The MBAR is read only and reflects the current address on the microprocessor memory bus. Its address on the PDP 11 bus is switch selectable from 760000 to 777774 (octal). The low order byte of the MDSR contains status bits and the upper byte is used for data transfers between the mini and the micro. The following chart shows the bit descriptions of these two registers.

THE PRICE. . .

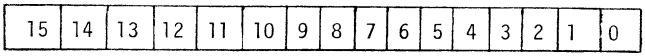
The full price for an assembled MINmic 1165 board, software package and manuals (including circuit diagrams) is $495. Everything is complete and ready to go. Plug the board in, load the software and start your microprocessor development immediately. If you're interested but we haven't completely convinced you yet, send us $5 and we'll rush the MINmic 1165 manual to you so you'll know in detail what the MINmic 1165 will do for you.

WHO WE ARE. . .

We have developed the majority of the support software offered by MOS/TECHNOLOGY. This includes cross assemblers for IBM, CDC and PDP 11 computers; NCSS, UCS and GE timesharing networks; plus all the MDT (Microcomputer Development Terminal) software which includes an assembler, text editor and fully symbolic disassembler. In addition, we are developing other software support packages which will be announced in 1976.

FUTURE PRODUCTS. . .

We are currently working on a full ine of MINmin products which include a power supply and chassis system which mounts MINmic RAM, ROM and I/O boards. Plus a native assembler board which will contain a full two pass MCS 6502 assembler so you can assemble microcomputer programs directly on the PDP 11. Plus a CPU board which will enable you to unplug your completed system from the PDP 11 and walk away with a complete microcomputer system which you know works. Plus . . .



MBAR (Microprocessor Bus Address Register)

BIT	NAME	DESCRIPTION (and type)
15-0	ADDRESS	MCS 6502 memory address (read only)

MDSR (Microprocessor Data & Status Register)

BIT	NAME	DESCRIPTION (and type)
15-8	DATA	Data written into or read from simulated memory (Read/Write)
7	SYNC	Current memory fetch is instruction opcode (Read only)
6	WRITE	Current memory reference is a write (Read only)
5	RESET	Will cause the processor to initiate a reset sequence when accompanied by the 'GO' bit. Processor will pick up new program counter from locations FFFC and FFFD, (Read/Write)
4	NMI	The transition of this bit from 0 to 1 will initiate a non-maskable interrupt. Current program counter and status will be stored on stack. New program counter will be loaded from FFFA and FFFB. (Read/Write)
3	IRQ	Interrupt is requested. Occurrence of actual interrupt is dependent upon the state of the interrupt mask bit in the processor status. When the interrupt is allowed, the current program counter and processor status will be saved on the stack. New program counter will be loaded from FFFE and FFFF. PDP software must clear this bit once MCS 6502 honors request or another interrupt will be requested. (Read/Write)
2	RUN	Allows the microprocessor to run at full speed with memory references answered by the "other memory." (Read/Write)
1	OTHER MEMORY	This bit is used in conjunction with either the 'RUN' bit or the 'GO' bit to pass memory references to a memory connected via the ribbon connector. This bit together with 'RUN' will let the processor run at full speed. Combined with 'GO' it will allow one memory reference to come from the other memory (Read/Write)
0	GO	This bit causes the processor to perform one cycle with the data in bits 15-8 of the MDSR. When this cycle is complete, a new bus address will appear in the MBAR. (Write only)

KIM-1 microcomputer system

KIM-1 SYSTEM DESCRIPTION

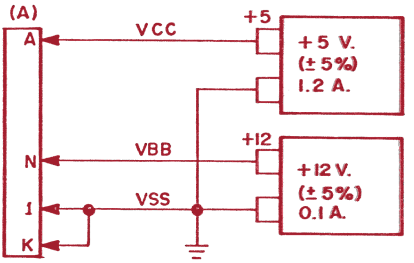
The MCS 6502 Microprocessor Array acts as the central control element for the system. This unit is an 8 bit microprocessor which communicates with other system elements on three separate buses. First, a 16 bit address bus permits the 6502 to address directly up to 65,536 memory locations in the system. Next, an 8 bit bidirectional data bus carries data from the 6502 array to any memory location or from any memory location back to the 6502 array. Lastly, a control bus carries various timing and control signals between the 6502 array and other system elements.

At the heart of the KIM-1 system is an MCS 6502 Microprocessor Array which operates in conjunction with two MCS 6530 arrays. Each MCS 6530 provides a total of 1024 bytes of Read-only Memory (ROM), 64 bytes of Random Access Memory (RAM), 15 input/output pins, and an Interval Timer. Stored permanently in the ROM's of the MCS 6530 arrays are the monitor and executive programs devised by MOS Technology, Inc. to control the various operating modes of the KIM-1 system.

The KIM-1 system is intended to provide a capable microcomputer for use in a "real-world" application. Accordingly, the system includes a full 1024 bytes of RAM to provide data and program storage for your application program. The 15 bidirectional input/output pins allow interface control of your specific application. One of the interval timers included in the system is available for generation of time base signals required by your application.

The KIM-1 system comes complete with all components mounted and tested as a system. You need not worry about timing signals (we've included a 1MHz crystal oscillator on the module), interface logic or levels between system components, or interface circuitry to peripheral devices. You need only apply the indicated power supply voltages to the designated pins to achieve full operation of the KIM-1 system.

You may expand the KIM-1 system to incorporate more memory, different types of memory, or additional input/output capability. System expansion is simple with all required interface signals brought out to a special connector on the module.

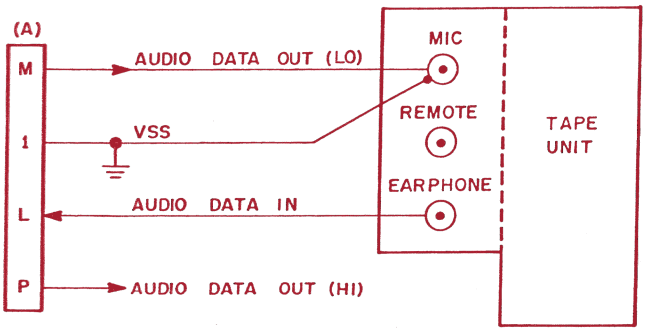


Power Supply Connections

Cont'd

The +12 volt power supply is required only if you will be using an audio cassette recorder in your system.

The recording technique used by the KIM-1 system and the interface circuits provided have been selected to insure trouble-free operation with virtually any type and any quality level audio cassette unit. (We have demonstrated correct operation with a tape unit purchased for less than $20.00 from a local discount outlet). In addition, tapes recorded on one unit may be played back to the system on a different unit if desired.

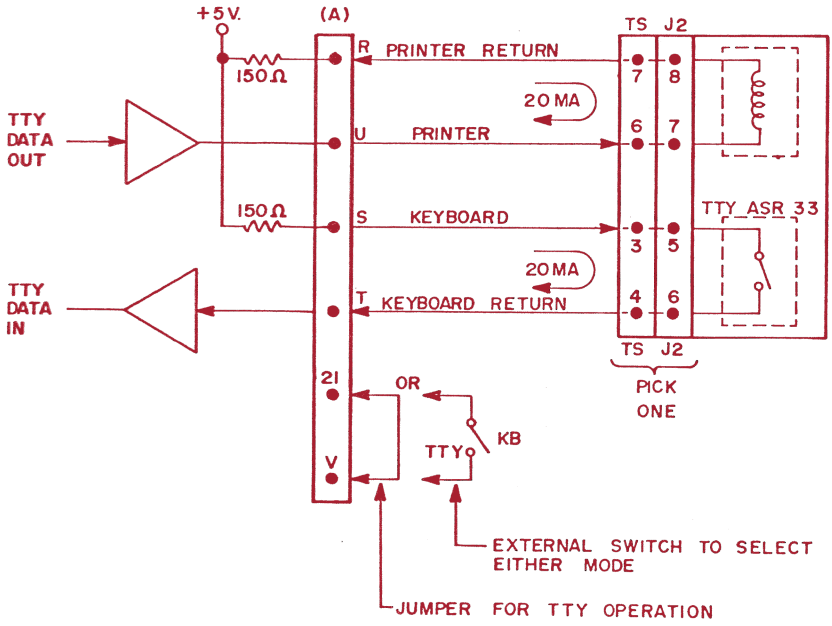


Audio Tape Unit Connections

ADDING A TELEPRINTER

A serial teleprinter, may be added to the KIM-1 system with very little effort.

The KIM-1 provides for a 4 wire interface to the TTY. You need not concern yourself with full or half-duplex configurations since the KIM-1 system will work with either. You are not restricted to units with specific bit rates (10 CPS for TTY) since the KIM-1 system automatically adjusts for a wide variety of data rates (10CPS, 15CPS, 30CPS, etc.).



TTY Connections

Simply press the [RS] key on the KIM-1 module then press the (RUB OUT) key on the TTY. This step automatically adjusts the KIM-1 system to the bit rate of the serial teleprinter.

Associated with the 6502 array is a 1 MHz crystal which operates with an oscillator circuit contained on the 6502 array. This crystal controlled oscillator is the basic timing source from which all other system timing signals are derived. In particular, the Ø 2 signal generated by the 6502 array and used either alone, or gated with other control signals, is used as the system time base by all other system elements.

The 6502 microprocessor is structured to work in conjunction with various types of memory. In the KIM-1 system, all memory may be considered to be of the Read-only (ROM) or Read/Write (RAM) variety. The ROM portion of the memory provides permanent storage for the operating programs essential to the control of the KIM-1 system. Two devices, labelled 6530-002 and 6530-003, each include a 1024 byte (8 bits per byte) ROM with different portions of the operating program stored permanently in each ROM.

RAM type memory is available at three locations in the system. Again, each of the 6530 arrays include 64 bytes of RAM primarily used for temporary data storage in support of the operating program. In addition, a separate 1024 byte RAM is included in the KIM-1 system and provides memory storage for user defined application programs and data.

Input/output controls for the system also are included within the 6530 arrays. Each 6530 array provides 15 I/O pins with the microprocessor and operating program defining whether each pin is an input pin or output pin, what data is to appear on the output pins, and reading the data appearing on input pins. The I/O pins provided on the 6530-002 are dedicated to interfacing with specific elements of the KIM-1 system including the keyboard, display, TTY interface circuit, and audio tape interface circuit. The 15 I/O pins on the 6530-003 are brought to a connector and are available for the user to control a specific application.

Finally, each 6530 array includes an interval timer capable of counting a specific number of system clocks to generate precise timing gates. The exact time interval is present under program control. The interval timer on the 6530-003 array is available for a user defined application program and is not required by the operating programs.

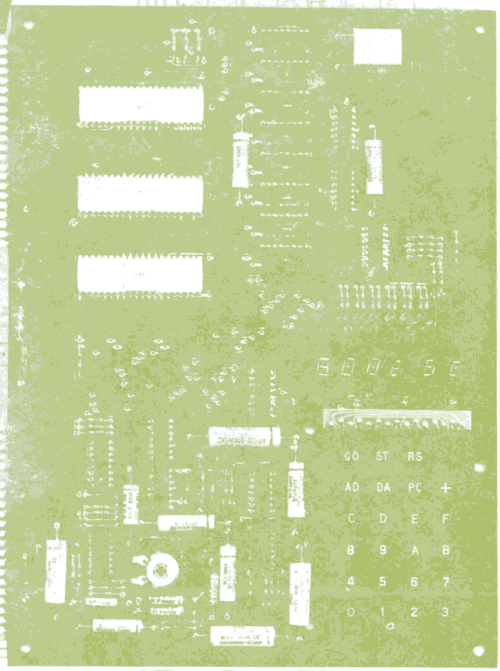
The following diagram shows a major block labelled Control Logic. Included under this category are an address decoder used for generation of chip select signals for the 6530 arrays and the static RAM. Also indluded is the logic required to debounce the keys for system reset (RS key) and program stop (ST key). Lastly, special logic is included to allow operation of the system in a "single instruction" mode to facilitate program debugging.

MEMORY AND I/O EXPANSION

In the KIM-1 system, the management of input/output data is handled exactly the same as transfers to or from any other memory location in the system. There are no instructions dealing specifically with input/output transfers. Instead, transfer of data is accomplished by reading from or writing to registers connected to the data bus and to I/O pins in specific interface devices (such as the 6530 array). These registers have a specific address in the system just as does any other memory location. Therefore, when we speak of expanding the memory of the KIM-1 system, we are defining the methods for expanding both the real memory (RAM, ROM, PROM, etc.) as well as the I/O ports since they are both treated exactly alike as far as address assignments are concerned.

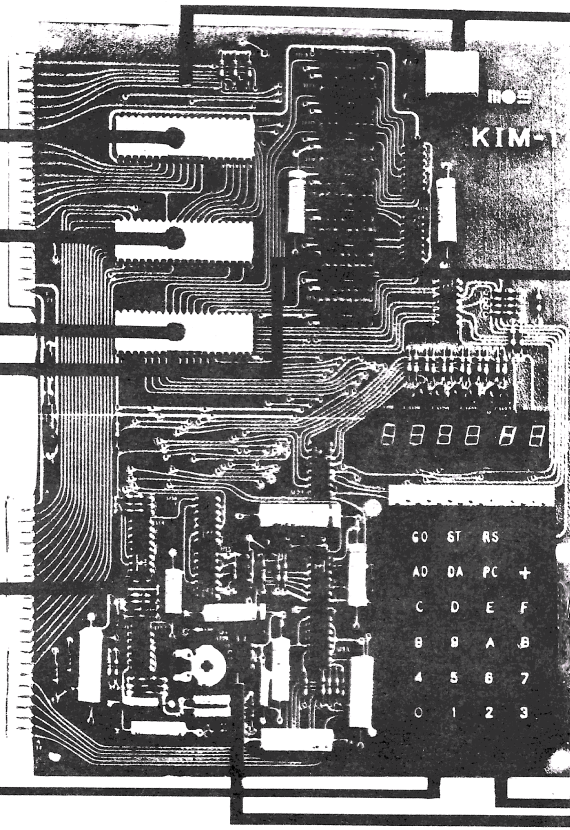
KIM-1 microcomputer system

- A COMPLETE MICROCOMPUTER
- ONLY $245
- NOT A KIT!
  - FULLY ASSEMBLED
  - FULLY TESTED
  - FULLY WARRANTED
- OPERATES WITH
  - KEYBOARD & DISPLAY
  - AUDIO CASSETTE
  - TTY
- INCLUDES
  - FULL DOCUMENTATION
  - MONITOR SOFTWARE



MOS TECHNOLOGY, INC.

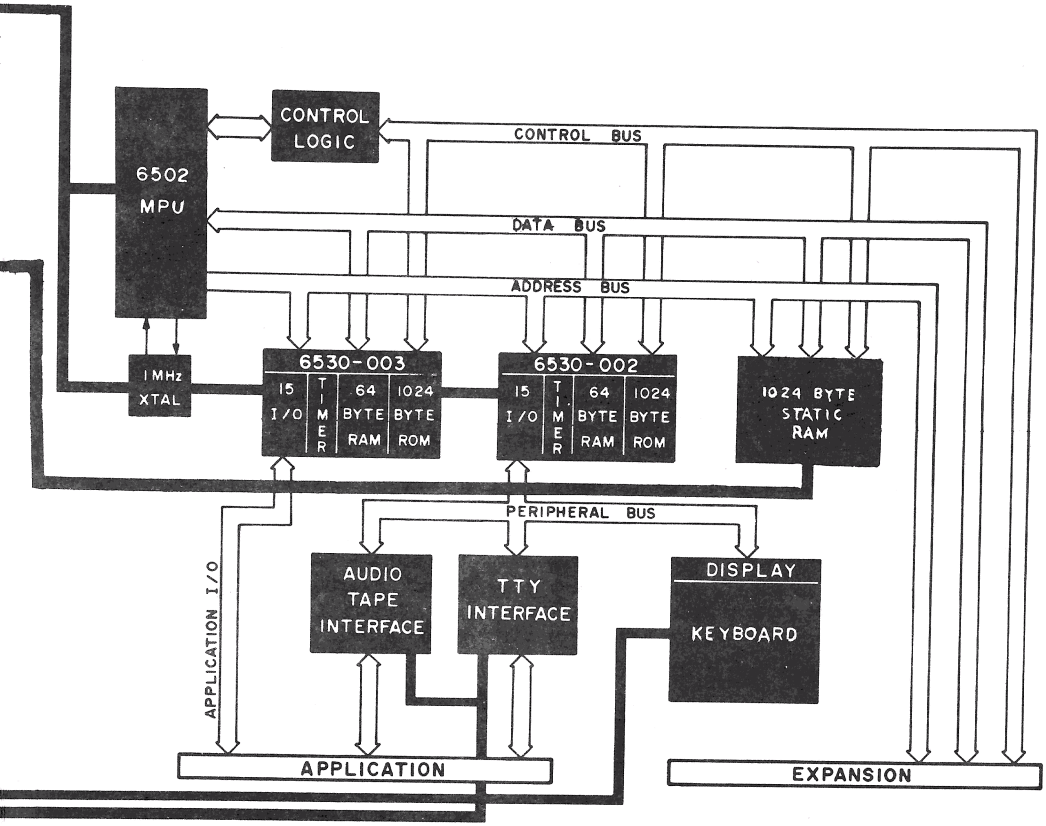
- 6502 MPU Array
- 6530 Arrays
  - 2048 ROM Bytes
  - 128 RAM Bytes
  - 30 I/O Pins
  - 2 Timers
- 1024 Byte RAM
- Interface & Control
  - Audio Cassette
  - TTY
- Keyboard/Display



KIM-1

- FOR EDUCATORS AND STUDENTS
- FOR EXPERIMENTERS AND HOBBYISTS
- FOR SYSTEM PROTOTYPING
- FOR INSTRUMENTATION AND TEST SYSTEMS

- THE MICROCOMPUTER SYSTEM FOR YOU!



KIM-1 ONE LOW PRICE INCLUDES

- HARDWARE - KIM-1 MODULE
- SOFTWARE - MONITOR PROGRAMS
  (STORED IN 2048 ROM BYTES)
- DOCUMENTATION-
  - KIM-1 USER MANUAL
  - KIM-1 SYSTEM SCHEMATIC (WALL SIZE)
  - 6500 HARDWARE MANUAL
  - 6500 PROGRAMMING MANUAL
  - 6500 PROGRAMMERS REFERENCE CARD

KIM-1 THE NOW MICROCOMPUTER!

KIM-1 is a complete microcomputer on a single printed circuit module. It comes to you completely assembled and tested at a price far less than most kits. Just connect your power supply (+ 5V at 1.2A, + 12V at 0.1A) and KIM-1 is operational in a matter of minutes. Need technical details? Refer to the complete User Manual, Hardware Manual, Programming Manual, or wall size Schematic included with your KIM-1.

KIM-1 THE LATEST IN TECHNOLOGY!

KIM-1 includes the MOS Technology, Inc. 6502 microprocessor array. The 6502 is an 8 bit MPU with a powerful instruction set, 13 addressing modes, multiple interrupts, and a full 65K address range (16 bits).

Also included in KIM-1 are two MCS 6530 Arrays (each with 1024 bytes of ROM, 64 bytes of RAM, 15 I/O pins, and an interval timer. The KIM-1 monitor and operating programs are stored permanently in the 2048 ROM bytes provided.

KIM-1 YOUR CHOICE OF PERIPHERALS

Use the KIM-1 keyboard and bright 6-digit LED display to enter programs, read memory contents, execute programs, and control system operation.

Next, add a low-cost audio cassette unit to your KIM-1 system to provide permanent bulk storage for programs and data (no need to blow expensive PROMS!). All required interface circuits for recording and playback of audio cassettes are included in the KIM-1 system.

Have access to a TTY (or equivalent)? Just connect four wires to add the TTY to the KIM-1 system. All interface circuits are included on the KIM-1 module. Now you can control the system from the TTY keyboard, produce hard copy printout, and punch or read paper tapes.

KIM-1 TO SOLVE YOUR APPLICATION PROBLEM

Store your programs in the 1024 byte RAM included on KIM-1. Debugging your program is simplified using the single step feature to trace program execution.

Use the 15 I/O pins provided to control your specific application circuits. Each I/O pin may be defined by the program to be either an input or an output pin.

Use the interval timer included in the KIM-1 system to generate fixed or variable time delays under program control.

KIM-1 A SYSTEM TO GROW WITH

Need more memory or I/O for more complex applications? KIM-1 is only the starting point. Expansion of the system to include up to 65K of memory is simplified since all required address bus, data bus, and control signals are available at one of the KIM-1 connectors. Memory may be of any type you choose (ROM, RAM, PROM; static or dynamic; high speed or low speed). I/O expansion is just as easy since every I/O port is addressed as if it were a normal memory location.

USE THIS FORM TO ORDER YOUR KIM-1 TODAY!

Please ship me_____ KIM-1 Systems at a cost of $245.00 per system plus $4.50 for shipping, handling and insurance (U.S. and Canada only)PA. residents add 6% sales tax.

If Ohio State Sales Tax applies, add $11.03.
Shipment will be made upon receipt of payment.

My check or money order is enclosed for $_____

Purchase from:

McSHANE
INCORPORATED
P. O. Box 523
Medina, Ohio 44256

Name _____

Address _____

City _____ State _____ Zip _____

HOW TO USE STANDARD 2102 MEMORIES WITH 6502 PROCESSOR CHIP?

By: Yogesh M. Gupta
New Concord, Ohio

The basic problem is in the write mode. The 2102 memories require the data to be stable for 800 nsec. before the trailing edge of the write signal and for a 'Data hold time' of 100 nsec. after the trailing edge of the write signal. Even if the 6502 processor is slowed down to 250 KHz. to obtain the data stability, the data hold time is not sufficient. The Figure 'A' shows how to generate $\emptyset_o$ (IN) clock for the 6502 and the $\overline{R/W}$ signal for the 2102 memories to solve this problem. It should be noted that now you have degraded the 6502 performance by 50% (500 KHz.). Figure 'B' shows the resultant timing relationships. Further, KIM-1 users will note that a 1 MHz. crystal is already provided on the board and $\overline{\emptyset 2}$ and R/W signals are available on the expansion connector. $\emptyset_o$ (IN) from 6502 can be brought out via jumper wire to one of the two unused pins on the expansion connector. When you change the operating frequency of your KIM-1 like this to 500 KHz., don't forget to readjust the running frequency of the phase lock loop for the audio cassette interface according to Page E-2 of your KIM-1 User Manual.

FIGURE 'A'

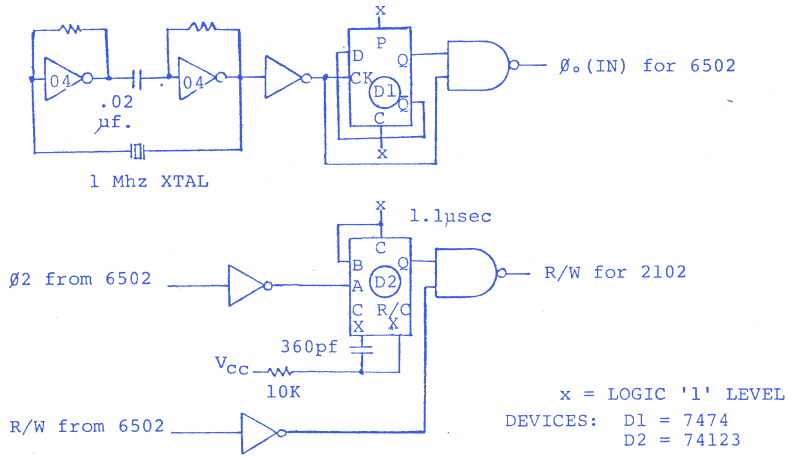
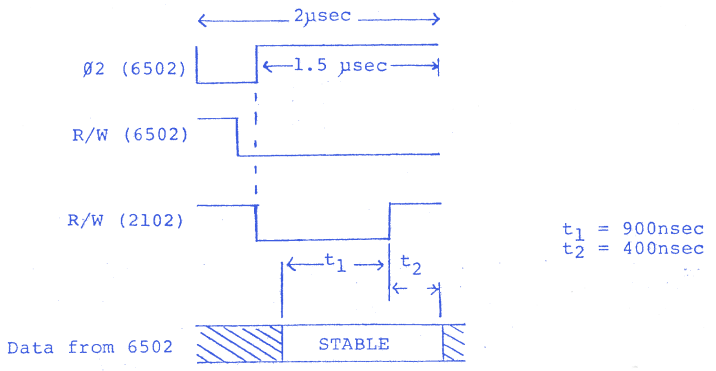
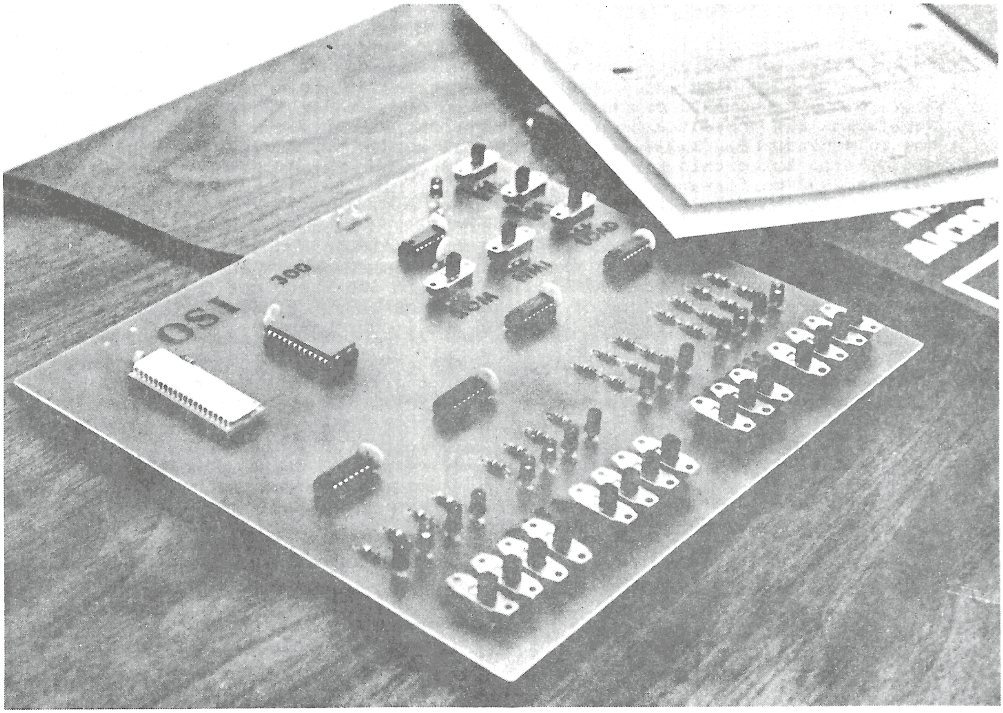


FIGURE 'B'
(Write Cycle)



MODEL 300 COMPUTER TRAINER

A COMPLETE, SELF CONTAINED COMPUTER ON A SINGLE PC BOARD



The Model 300 is a completely assembled and tested, ready to use, computer designed to "bootstrap" the student, hobbyist, and engineer into the microcomputer world. The unit comes complete with a 20 experiment lab manual written for use in a college physics, electronics, or computer course. Since the manual assumes no previous knowledge of computers or digital electronics, it is also ideal for self-teaching. The first experiment is simply loading and reading memory. The last experiment is interfacing the computer to a teletype.

The unit has 128 words of memory (8 bits wide) and is based on the MOS Technology 6502 microprocessor which has 55 basic instructions with over 145 variations. The processor does binary, twos complement, and binary coded decimal arithmetic. It also features interrupt capability and has 13 memory addressing modes. The lab manual covers virtually all instruction types and programming procedures.

The unit also has a sync line for easy scoping of circuit points. Two input lines and one output latch are provided for I/O programming. The output latch can be connected to an audio amplifier to produce tones and even "tunes."

SPECIFICATIONS

CONTROLS: 8 Data Switches for loading programs and data.
7 Address Switches for addressing 128 words of memory and examining memory contents.
Memory Load - deposits data switches at memory location specified by address switches when momentarily actuated by computer halt.
Processor Reset - forces reset of computer and loads restart vector into program counter.
Process Run - runs and halts computer.
Interrupt - forces a non-maskable interrupt when momentarily actuated.
Memory Write Protect - converts the memory to a read only memory (ROM) when activated.

DISPLAYS: 8 Data LEDs - display contents of data bus.
7 Address LEDs - display current memory address.
Run - indicates execution of a program.

INPUTS: IRQ - maskable interrupt request, low true, TTL compatable.
SO - Set overflow bit, TTL compatable.
OUTPUT: one TTL compatable latch set high by addressing page 2 and set low by addressing page 1.
SYNC: TTL level for triggering a standard scope with op code execution.
PERFORMANCE: The 6502 is capable of operating at 500ns. cycle time (1.5u sec. Jump Absolute). The Model 300 runs at approximately 2u sec. cycle time but can be varied by the user.
MECHANICAL: 8"x10"x1" overall. G-10 epoxy board using standard industrial
POWER REQUIREMENTS: 5VDC at 500 ma maximum. 350ma typical. The unit will operate for approximately 20 hours from 4 alkaline "D" cells.
GUARENTEE: 90 days materials and workmanship.
DELIVERY: Stock to 30 days.
PRICES: (F.O.B. Medina, Ohio)

MODEL 300 COMPUTER TRAINER COMPLETELY ASSEMBLED AND TESTED WITH LAB MANUAL (requires +5DC at 500 ma).....$99.00
110VAC Calculator Type Power Supply ADD.....$10.00
MOS 650X Hardware and Programming Manuals ADD.....$10.00
MODEL 305 SAME AS MODEL 300 BUT LESS 6502 PROCESSOR.....$74.00

ANNOUNCING THE OSI 315

AN ASTOUNDING NEW CONCEPT IN HOBBY COMPUTING!

Here's how it works:

You order a Model 315 for $129.00 plus shipping. You will receive a Model 315 (identical to the Model 300) Computer Trainer completely assembled and tested (may be new or used unit) complete with 20 experiment lab manuals (new), and manufacturer's specification sheets on the 6502.

You then return the Model 315 in good working condition within 60 days of date of receipt (but you keep the documentation). You will then receive the following items:

Item		Value
A.	Model 400 Superboard and Documentation	29.00
B.	Model 430 Super I/O Board and Documentation	29.00
C.	Model 440 Super Video Board and Documentation	29.00
D.	TV Typewriter and Audio Cassette Monitor Software	19.00
E.	Shipping and Insurance on A, B, C, and D	4.00
	TOTAL VALUE	$110.00

This is in addition to the Computer Trainer manual (value ($10.00) so the value of the items you have comes to $120.00 total meaning that you have paid $9.00 for two months rent of a Computer Trainer! You are now on your way to constructing the most powerful system available to the hobbyist!

The 315 Plan is designed specifically for the electronics hobbyist who has little or no "hands on" experience with computers. The hobbyist will have the opportunity to get a good understanding of programming and hardware before he builds his own system based on the Model 400. This will allow him to tailor the 400 system to his own requirements.

The three boards provided in the 315 Plan provide a complete hobby computer including video alphanumeric display on a conventional television set and an audio cassette interface for program storage. Many extras can be added to the boards such as a parallel and serial interface, D/A converters and so on.

The three boards which are available through the 315 Plan are described in further detail in other sections of this flyer.

Fine Print

Delivery of the Model 315 Computer Trainer is 30 to 60 days after receipt of order. The boards will be shipped within 30 days of the return of the trainer. OSI has final authority on what constitutes "good working condition." The trainer must be postmarked no more than 60 calendar days after receipt of the unit (date determined by Post Office Delivery Receipt). This offer is good only in the continental United States. No substitutes allowed. However, parts may be purchased from OSI to populate the boards. Model 300s and 305s can not be converted to this plan. This offer applies only to individuals and to PREPAID orders only!

OSI MODEL 400 SUPERBOARD

Accepts:
- 6501, 6502
- System Clock
- 2 - 1702 Type PROMs
- 8 - 2102 Memories
- 1 - 6820 PIA or 6530-004 PIA/ROM (TIM)
- 1 - 6850 ACIA
- ACIA Clock, Current Loop, and RS-232 Interfaces

The Model 400 Superboard and accessory boards are 8"x10" double sided G-10 glass epoxy with 2 oz. copper foils. The boards do not have plated through holes. This adds less than two hours to the assembly time, but realizes a savings of $10 to $20 per board. It should also be noted that a faulty plated through hole can take considerably longer than two hours to find!

The Superboard comes complete with a 50 page theory of operation and construction manual and manufacturer's specifications sheets on all components used on the board. Optional documentation includes the OSI Model 300 manual which applies directly to the 6501 and 6502 systems. A 400 page manufacturer's manual set is available on the 6501 and 6502; consisting of a Hardware manual ($5.00) and a Programming manual ($5.00) available from McShane, Inc. The documentation provided is designed to be adequate for the experimenter who can successfully build TTL circuits from schematics or a magazine article.

Use of Superboard results in an extremely powerful and versatile computer which can be used alone with a terminal or with an I/O device and a dedicated program as a low cost, extremely versatile, high speed controller. The Superboard is expandable via OSI system expansion boards. Multi-processing with several 500ns cycle time Superboards can provide computer capability rivaling the largest computers now available at a cost below most minicomputers.

The Model 400 is designed to be as general purpose as possible without resorting to an excessive number of wire jumpers for any specific application. The board can be used with the 6501 or 6502 microprocessor. The board can be configured minimally with a processor, 1,024 bytes of RAM memory, and an external front panel. Maximally, it can have a processor with a clock system which will service three different memories, 512 bytes of PROM, 1,024 bytes of RAM, an ACIA with RS-232 or 20ma loop interface, a PIA with 16 I/O lines and full buffering for system expansion.

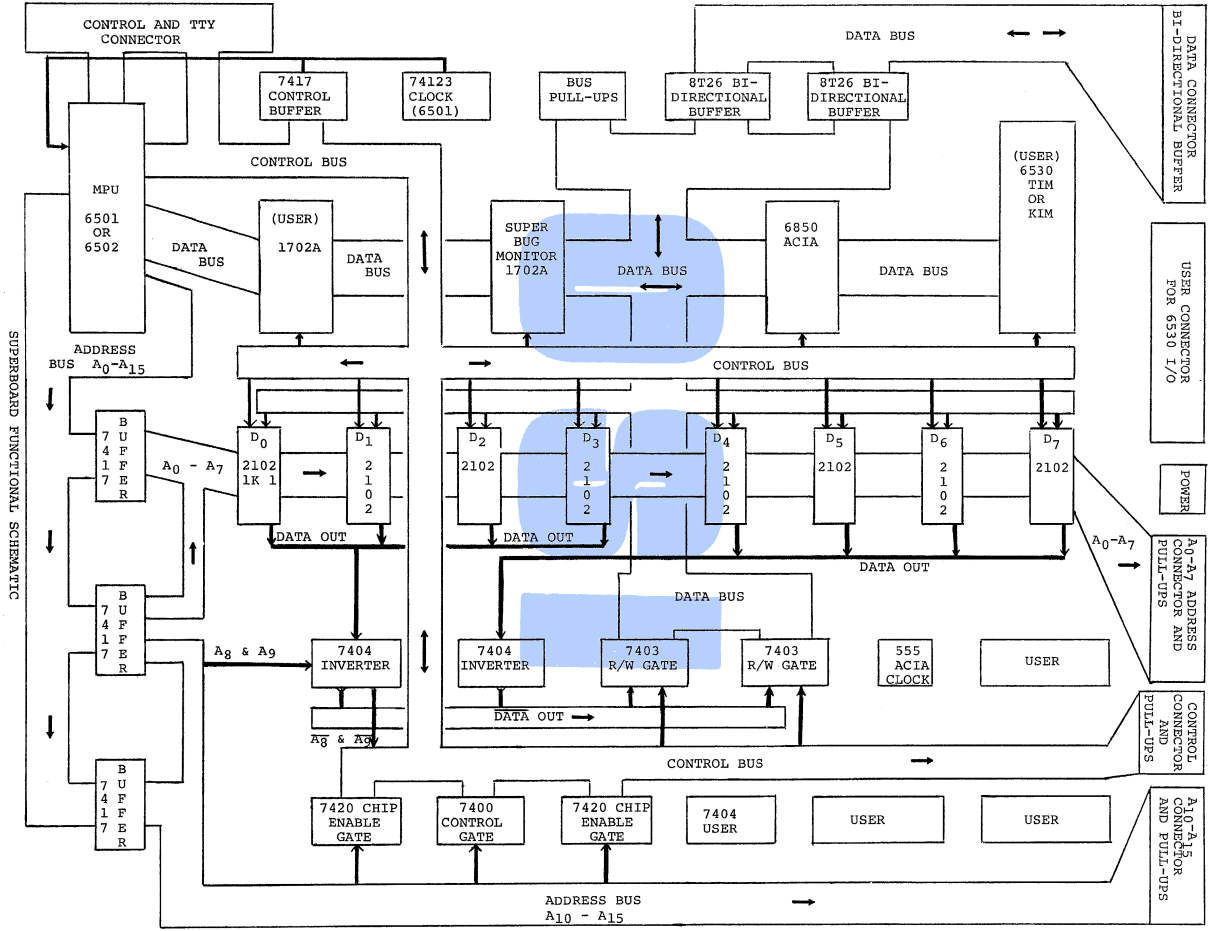
INTERFACING TO THE SUPERBOARD

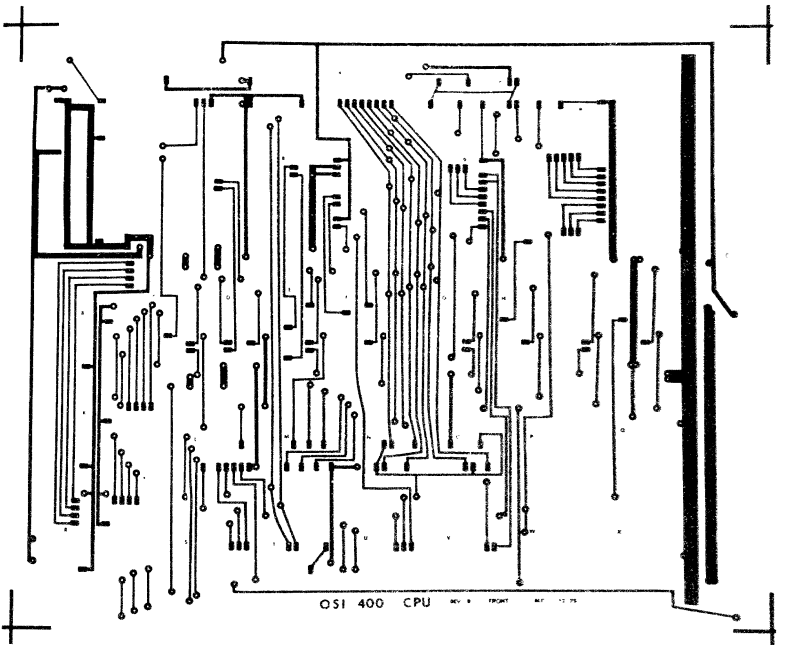
The Superboard is designed for expansion via a 48 line system bus. This bus is common to the 6501 and the 6502. The bus will also support the soon to be announced 16 bit "byte at a time" MCS 6509. Thus, the entire 400 system has been very carefully designed to be protected from obsolescence.

All OSI 400 system boards utilize the bus. In small systems, the boards are simply connected together (line 1 to line 1, line 2 to line 2, etc.). In systems incorporating multiple processors and/or multiport memories, bus signals are gated between local areas of the bus.

The Model 400 Superboard is in stock at McShane and will be shipped within 24 hours of receipt of order. The board and manual is priced at $29.00. The board alone is priced at $25.00. Include $4.00 shipping and handling.

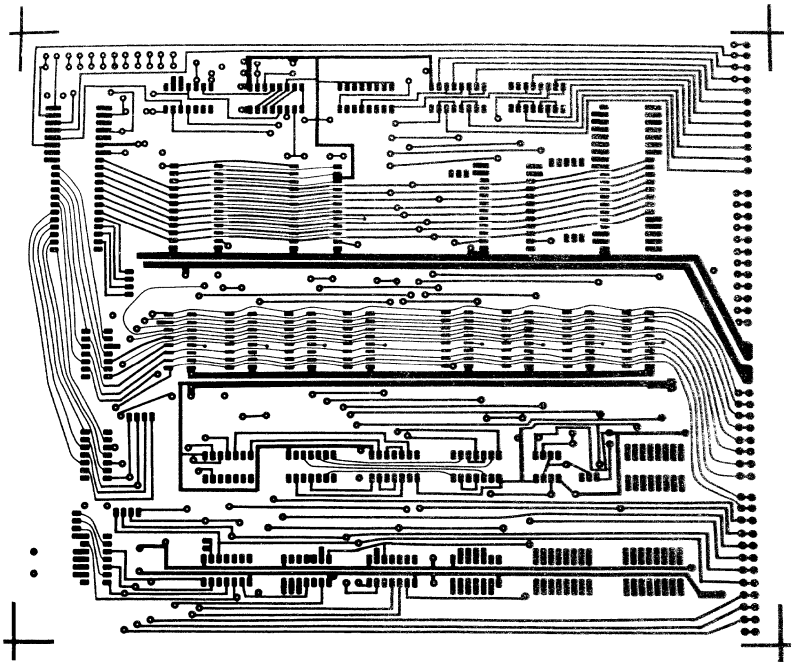
Superboard foil, two pages ahead.


SUPERBOARD FUNCTIONAL SCHEMATIC
CONTROL AND TTY CONNECTOR
7417 CONTROL BUFFER
74123 CLOCK (6501)
BUS PULL-UPS
8T26 BI-DIRECTIONAL BUFFER
8T26 BI-DIRECTIONAL BUFFER
DATA BUS
DATA CONNECTOR BI-DIRECTIONAL BUFFER
CONTROL BUS
MPU 6501 OR 6502
DATA BUS
(USER) 1702A
DATA BUS
SUPER BUG MONITOR 1702A
DATA BUS
6850 ACIA
DATA BUS
(USER) 6530 TIM OR KIM
USER CONNECTOR FOR 6530 I/O
ADDRESS BUS A_0-A_{15}
CONTROL BUS
BUFFER 74177
A_0 - A_7
D_0 2102 1K 1
D_1 2102
D_2 2102
D_3 2102
D_4 2102
D_5 2102
D_6 2102
D_7 2102
POWER
DATA OUT
DATA OUT
DATA OUT
A_0-A_7
A_0-A_7 ADDRESS CONNECTOR AND PULL-UPS
DATA BUS
BUFFER 74177
A_8 & A_9
7404 INVERTER
7404 INVERTER
7403 R/W GATE
7403 R/W GATE
555 ACIA CLOCK
USER
DATA OUT
A_8 & A_9
CONTROL BUS
CONTROL CONNECTOR AND PULL-UPS
BUFFER 74177
7420 CHIP ENABLE GATE
7400 CONTROL GATE
7420 CHIP ENABLE GATE
7404 USER
USER
USER
A_{10}-A_{15} CONNECTOR AND PULL-UPS
ADDRESS BUS A_{10} - A_{15}



COMPONENT SIDE OF SUPERBOARD

REAR OF SUPERBOARD AS SEEN FROM COMPONENT SIDE



PRODUCT DESCRIPTION AND PRICES

	Price	Add for Shipping and Handling
The following is available for immediate delivery from our stock:		
MCS6502 MICROPROCESSOR	$25.00	$2.00
MCS6530-004 (INCLUDES TIM MANUAL)	$30.00	$2.00
MCS6530-005	$18.00	$2.00
KIM-1 SYSTEM (INCLUDES ALL DOCUMENTATION)	$245	$4.50
MOS TECHNOLOGY HARDWARE MANUAL	$ 5.00	$2.00
MOS TECHNOLOGY SOFTWARE MANUAL	$ 5.00	$2.00
MOS TECHNOLOGY CROSS ASSEMBLER MANUAL	$ 4.00	$2.00
MOS TECHNOLOGY TIM MANUAL (ALONE)	$ 4.00	$2.00
WELLS ZERO-INSERTION-FORCE, WIPING CONTACT SOCKETS (QUANTITIES 1-24):		
14 pin - Cat. No. 604011411	$ 3.02	$2.00
16 pin - Cat. No. 604011611	$ 3.42	$2.00
24 pin - Cat. No. 604012411	$ 4.63	$2.00
40 pin - Cat. No. 604014011	$ 6.95	$2.00
MODEL 400 SUPERBOARD WITH DOCUMENTATION	$29.00	$4.00
MODEL 400 SUPERBOARD WITHOUT DOCUMENTATION	$22.00	$4.00
MODEL 402 SUPERBOARD WITH DOCUMENTATION AND MOS TECHNOLOGY 6502 (1MHZ GUARANTEED, 2MHZ TYPICAL)	$54.00	$4.00
MANUAL ONLY FOR 400/402	$10.00	$2.00
The following have 30 to 60 day deliveries:		
MPS6503 MICROPROCESSOR	$20.00	$2.00
MPS6504 MICROPROCESSOR	$20.00	$2.00
MPS6505 MICROPROCESSOR	$20.00	$2.00
MCS6502A MICROPROCESSOR	$37.50	$2.00
MPS6503A MICROPROCESSOR	$30.00	$2.00
MPS6504A MICROPROCESSOR	$30.00	$2.00
MPS6505A MICROPROCESSOR	$30.00	$2.00
MODEL 300 COMPUTER TRAINER	$99.00	$4.00
MODEL 315 COMPUTER TRAINER	$129.00	$4.00
MANUAL ONLY FOR 300/315	$10.00	$2.00
65A PROM (FOR 6501 OR 6502 SYSTEM AND ASCII TERMINAL)	$29.00	$3.00
65B PROM (FOR 6501 OR 6502 SYSTEM AND BAUDOT TERMINAL)	$34.00	$3.00
65V PROM (FOR 650X AND SUPER VIDEO BOARD)	(See Next Issue)	
6820 PIA (16 LINE PARALLEL INTERFACE)	$15.00	$1.00
6850 ACIA (SERIAL INTERFACE)	$15.00	$1.00
8-2102-6 650NS WORST CASE CYCLE TIME MEMORIES FOR USE WITH 1US SYSTEMS	$24.00 PER 8	$8.00
8-2102A-2 250NS WORST CASE CYCLE TIME MEMORIES FOR USE WITH 500 NS AND FASTER SYSTEM	$46.00 PER 8	$2.00
8T26 QUAD BUS TRANSCEIVERS	$ 8.00 PER PAIR	$1.00
MODEL 420 MEMORY EXPANSION BOARD (CAN BE CONFIGURED FOR 4K BY 8 OR 4K - 12 OF 2102 TYPE MEMORIES).		
WITH DOCUMENTATION	$29.00	$4.00
WITHOUT DOCUMENTATION	$25.00	$4.00
MODEL 430 SUPER I/O BOARD		
WITH DOCUMENTATION	$29.00	$4.00
WITHOUT DOCUMENTATION	$25.00	$4.00
1408L8 D/A CONVERTER	$ 9.00	$2.00
S1883 UART	$10.00	$2.00
MODEL 480 BACKPLANE. AN 8"x10" 8 SLOT BACKPLANE BOARD AND ALL CONNECTORS FOR THE BACKPLANE AND EIGHT MATING BOARDS. THE BOARD HAS PROVISIONS FOR ADDRESS BUFFERING AND CAN BE DAISY CHAINED	$29.00	$4.00
MODEL 495 PROTOTYPING BOARD. A SYSTEM COMPATABLE PROTOTYPING BOARD FOR POINT TO POINT WIRING (3 HOLES PER IC PIN) OR WIRE WRAPPING. HOLDS EIGHT 40 PIN PACKAGES AND EIGHTY 16 OR 14 PIN PACKAGES. THE BOARD HAS +5 AND GROUND DISTRIBUTION AND OVER 1,500 HOLES	$29.00	$4.00

COMING SOON:

MODEL 440 SUPER VIDEO GRAPHICS BOARD PERFORMS TV TYPEWRITER FUNCTIONS WITH A 32 BY 32 CHARACTER DISPLAY (5 BY 7 DOT MATRIX) WITH ITS OWN 1K BY 6 2102 MEMORY ON A CONVENTIONAL TV. BY SHARING A 4K MEMORY BOARD (MULTI-PORTING) 128 BY 128 CELL VIDEO GRAPHICS CAN BE GENERATED. TWO ADDITIONAL 440 BOARDS MAY BE SLAVED FOR TRUE RGB COLOR DISPLAY. THE MULTI-PORT MEMORY SCHEME ALLOWS REAL TIME MOTION SINCE THE PROCESSOR IS NOT PARALYSED BY DMA DURING VIDEO DISPLAYS.

MODEL 450 FIRMWARE BASIC BOARD USES MOS TECHNOLOGY SCIENTIFIC CALCULATOR CHIP FOR ALL ARITHMETIC FUNCTIONS AND UP TO 4K OF PROM MEMORY. THE PROMS MAY CONTAIN A USER PROGRAM OR OSI FIRMWARE BASIC FOR THE 650X. THE BOARD IS TENTATIVELY USING THE NEW AMI 6834 PROMS AND FEATURES AN ON-BOARD PROM PROGRAMMER.

MODEL 460 PDP-8 EMULATOR. THIS BOARD CONTAINS AN INTERSIL 6100 MICROPROCESSOR AND COMMUNICATIONS INTERFACE TO A 650X BASED SYSTEM. THE BOARD MINIMALLY REQUIRES A 6502 BASED 400 BOARD AND A 4K BY 12 420 MEMORY BOARD FOR SUPPORT. IT CAN COMMUNICATE WITH THE 6502 VIA STANDARD PDP-8 I/O PORTS (TTY, HIGH SPEED PAPER TAPE, ETC.) OR VIA SHARED MEMORY. WHEN FULLY POPULATED, THE BOARD WILL RUN ALL PDP-8 SOFTWARE WITHOUT MODIFICATION SINCE THE 650X WILL SIMULATE ALL I/O DEVICES.

MODEL 470 FLOPPY DISK INTERFACE. OSI IS DEVELOPING A FLOPPY DISK SYSTEM BASED ON THE GSI MODEL 105 DISKETTE DRIVE. THE COST OF IMPLEMENTING THE DRIVE AND INTERFACE WILL BE ABOUT $600...(AVAILABLE MAY-JUNE)

On multiple item orders, only shipping charge of highest item applies.
Add Ohio State tax of 4.5% when applicable.
Ohio customers: supply exemption certificate number if tax does not apply.
Merchandise will be shipped on receipt of payment.

Direct purchase orders to McShane, Inc.
Checks should be made payable to McShane, Inc.

COMING EVENT. . .

The next meeting of the Cleveland Digital Group will be held at 2:00 P.M. April 11, 1976 at the Hurlbert Lecture Hall, Colter Turner Labs, Hiram College, Hiram, Ohio. The meeting is sponsored by OSI. OSI will hold open house following the meeting. You are welcome to attend.

REGIONAL EVENTS AND MEETINGS OF OTHER ORGANIZATIONS WILL BE LISTED UPON RECEIPT OF SCHEDULE.

NEXT ISSUE: Interfacing 6502 to Position Indicators and Drivers
Interfacing 6502 to Calculator Chips
Interfacing 6502 to Analog Information

Your Article Contributions Are Welcome. Drop us a note and tell us what you would like to see in the uP.

THE uP IS A REGIONAL PUBLICATION ESTABLISHED FOR THE PURPOSE OF DISTRIBUTING INFORMATION ON McSHANE'S MICROPROCESSORS AND MICROPROCESSOR RELATED PRODUCTS. IF YOU KNOW OF ANY INDIVIDUALS WHO HAVE INTERESTS ALONG THESE LINES AND SHOULD BE ADDED TO OUR MAILING LIST, PLEASE ADVISE US OF THEIR NAME AND MAILING ADDRESS.

NEW PRODUCT

Transistor devices has just announced a low-cost wide range electronic load known as DIAL-A-LOAD, the one half rack wide instrument features multi-range instrumentation and simplified operation to make conventional instrumentation rheostats, heaters, bulbs, and clip leads a thing of the past. Other features are:**3 range Ammeter**coarse and fine load adjust**AC/DC on-off circuit breaker**short circuit contact**convection cooled**overcurrent protected **overpower protected**5-way binding post input**convenient carrying handle doubles as a stand.

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McSHANE
Box 523
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We are making a survey to define the market for microprocessors and related devices. We need your help.

1. Is your interest in microprocessors related to your BUSINESS_____ or HOBBY_____?
2. Is your company now using microprocessors? YES_____ NO_____
3. Which device are you using?_____
4. Approximately how many devices per year?_____
5. How many different products manufactured by your firm use microprocessors now?_____, planned for the year?_____
6. Do you use I/O devices? YES_____ NO_____
   UART? YES_____ NO_____ If so, how many per year?_____
   PIA? YES_____ NO_____ If so, how many per year?_____
7. Are any new projects to be started in the next twelve months? YES_____ NO_____
   Could they use MOS technology processors? YES_____ NO_____
8. Do you have a development system such as:

   MDS_____, INTELLECT_____, EXORCISOR_____, _____

Regardless of your answers and even if you are only a hobbyist, you will be kept on the uP mailing list. Since our business is marketing of these devices, factual answers would be greatly appreciated.

After completing this form, "cut" along the dotted line, fold the page in half, staple or tape folded and mail. No postage is required. Thanks!

McShane, Inc.
P. O. Box 523
Medina, Ohio

FIRST CLASS MAIL

AKRON. OH 443
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1976

Mr. Bob Findlay
CMU D/Physics
5000 Forbes Ave.
Pittsburgh, Pa. 15213

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